CYCLODIALYSIS: A SERIES OF OPERATIONS UPON THE EYES OF RABBITS

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Cyclodialysis: A Series of Operations Upon the Eyes of Rabbits.

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Fuchs and Axenfeld observed that in a large percent of cases operated upon for glaucoma, in which incisions into the anterior chamber, were made, a detachment of the choroid occurred and they believed it possible that the beneficial results were due to the detachment. With the observations of these men in mind Heine conceived the idea which resulted in the operation which he called cyclodialysis or which is known as the Heine operation, and which he first described in 1905(1)

The outstanding feature of the operation is the establishment of a communication between the anterior chamber and the suprachoroidal spaces, secured by inserting a spatula thru a small incision in the conjunctiva and sclera, posterior to the limbus, and passing it forward between the sclera and ciliary body into the anterior chamber, and by gentle sweeping movements separating these structures.

For the technique of the operation the reader is referred to works on ophthalmic surgery.

Heine's original theory concerning the modus operandi of the operation was that the contraction of the ciliary muscle pulled the ciliary body away from the sclera, preventing its reattachment, and thus formed a permanent filtration path. Experimental work and studies of the operated eyes have, however, disproved this and he has since modified his theory and now considers that a capillary fistula formation occurs between the ciliary body and sclera which drains the aqueous humor from the anterior chamber.

Other observers hold different views. Krauss(2) found in his experiments on animals that there was firm attachment formed between the ciliary body and the sclera. He believes that the reduction in tension is due to atrophy of the ciliary body from trauma with a reduction of secretion of aqueous.

The same view is shared by Pyle(3), Meller(3), Gifford(3),

Wychodtzew (3), Judin(3), Elsberg (3), Salus (3) and others. Wernicke (4) found a delicate cicatrix between the ciliary body and the sclera and thinks this may drain the aqueous from the anterior chamber. Blatt (5) feels that the neurogenic view as to the origin of glaucoma should be considered and states that "Possibly the tension reducing effect of cyclodialysis is brought about thru the destruction and dissolution of continuity of the ciliary nerves of the suprachoroidal and supraciliary tissues" Gradle (3) believes the reduction in tension is due to freeing the angle of the anterior chamber, allowing the aqueous to escape thru the canal of Schlemm. This theory has perhaps the greatest number of adherents.

The various views naturally lead to a difference of opinion as regards indications and contraindications, thus influencing the selection of cases, and eventually determining the status of the operation in the minds of the ophthalmic surgeons.

With these facts in mind a series of experiments upon rabbits was undertaken to determine the effect of cyclodialysis upon the tension of the eye and, if possible, the modus operandi of the operation, hoping thereby to arrive at some definite conclusions.

The series consists of fourteen cases in which the right eye only, of each animal was operated; the left being used as a control in taking the tension.

The latter was in most cases, also operated at the time the right eye was enucleated and the animal killed, in order to determine the amount of trauma, etc. immediately following the operation. The operations were performed under ether anaesthesia, according to the technique described by Meller(11) and with due care as to asepsis.

Rabbit No. 2.

Operated Feb 2, 1925.

Soon after the operation was completed it was discovered that a very small quantity of blood had oozed into the anterior chamber. This was absorbed within 24 hours. On the second day the cornea showed a small faint opacity at the limbus which persisted. The slitlamp showed this to be in the substantia propria and due to injury of Descemet's membrane by the spatula as it entered the anterior chamber. The reaction was moderate and had practically disappeared by the fifth day. It was noted in this as well as all other operations that the iris quickly contracted as soon as the separation of the ciliary body was made, the contraction remaining 2 to 4 days.

Day ofter operation	*	1	2	5	7	9	12	15	18	22	28	32
Tension O. D.	19	16	18	18	16	18	16	17	18	18	17	18
Tension O.S.	19	19	20	20	20	18	20	18	18	19	18	18

Histologic examination showed the incision healed. The ciliary body and sclera were firmly adherent, the former line of separation being seen with difficulty. The ciliary body and processes were normal in appearance. There was a small anterior synechia near the angle of the anterior chamber. The root of the iris, however, was free. With the exception of the synechia the appearance was practically the same as an unoperated eye.

Rabbit No 3.

Operated Feb 2, 1925.

There were no untoward accidents. The reaction was very slight. The rabbit was killed and eye enucleated Apr 23.

Day after operation.	*	1	2	5	7	9	12	15	18	22	28	32	35	40	43	46	51	53
Tension O. D.	18	12	10	18	14	19	18	18	20	17	18	18	18	15	18	17	18	18
Tension O. S.	18	17	18	18	15	18	19	19	19	20	19	18	20	18	19	19	20	19

Day after operation.	59	61	65	71	79	81
Tension O. D.	18	20	19	18	19	19
Tension O. S.	19	20	20	19	19	19

Histologic examination:

The point of incision in the sclera was filled in with scar tissue with adhesion of the choroid at this point. There was slight round cell infiltration. The ciliary body had become reattached and as in case 2 there was practically nothing to indicate the line of separation. The ciliary body and its processes were normal.

Rabbit No 4.

Operated Feb. 3,

Slight oozing of blood into anterior chamber occurred. Examination next day showed slight cloudiness of cornea at site of operation. The hemorrhage was gradually absorbed and had disappeared on the 12th day after operation. Reaction- slight, lasting about 5 days. The corneal haze remained very faint.

Rabbit escaped from cage and was found dead March 6. Eye therefore not secured.

Day after operation.	*	1	2	4	6	8	11	14	17	21
Tension O. D.	22	12	12	13	13	18	18	19	15	13
Tension O. S.	20	19	20	20	20	22	19	20	19	19

Rabbit No. 5.

Operated Feb. 3,

No accidents at time of operation. Examination 24 hours later showed small blood clot at angle of anterior chamber and very small dot of corneal haze at limbus near site of wound. Reaction slight. Blood clot absorbed after 3 days but small opacity remained.

Rabbit killed and eye enucleated April 21, 78 days after operation.

Day after operation.	*	1	3	4	6	8	11	14	17	21	25	29	35	38	40	43	46	49
Tension O. D.	20	15	19	20	13	18	18	16	19	19	18	18	18	18	17	17	18	19
Tension O. S.	19	19	18	17	15	20	18	18	19	19	17	18	17	20	19	18	17	19

Day after operation.	51	53	59	63	71	78
Tension O. D.	18	18	18	17	18	18
Tension O. S.	18	18	19	20	18	19

Histologic examination:

The scleral incision healed with but slight scar. The ciliary body and prodesses were normal and showed but faint evidence of the operation. There were no synechiae.

Rabbit No. 6.

Operated Feb. 3, 1925.

Operation satisfactory. Reaction slight, disappearing by the fifth day. On the fourth day the cornea was slightly abraded by the tonometer but had healed by the sixth day. Eye in excellent condition otherwise.

Day after operation.	*	2	4	6	8	11	14	17	21	24	28	30
Tension O. D.	20	14	15	20	20	18	18	20	19	19	18	19
Tension O. S.	20	20	19	20	19	18	22	22	17	20	20	20

Histologic examination:

The incision had healed with slight thinning of the sclera. There was a small area of edema between the retina and choroid near the area of the incision. The ciliary body was to all appearances normal and the only evidence of the operation in this region was some increase in pigment along the line of reattachment of the ciliary body to the sclera.

Rabbit No. 7.

Operated Feb. 5, 1925.

Operation satisfactory. Reaction slight and had practically disappeared by the fourth day. Rabbit killed April 14.

Day after operation.	*	2	4	6	9	12	16	21	24	28	31	34	37	39	42	45	50	54	59	63	69
Tension O. D.	20	15	14	17	18	20	18	17	18	17	17	19	17	18	18	18	20	17	19	18	18
Tension O. S.	20	20	20	19	20	20	20	19	19	20	20	20	18	19	20	20	25	20	19	18	19

Histologic examination: The scleral wound had healed with some deposition of choroidal pigment in the incision. The ciliary body had become reattached and was of normal appearance.

Rabbit No. 8.

Operated Feb. 5, 1925. There were no accidents but a very small area of haziness at the limbus was noted the next day which was still present when the eye was enucleated. The reaction was moderate.

Day after operation.		2	4	6	9	12	15	19	23	25	29	32	35	37	40	43	49	51	56	60
Tension O. D.	18	15	13	14	18	19	15	13	13	15	19	19	18	19	17	17	18	19	17	18
Tension O. S.	17	19	17	17	18	17	17	18	18	17	19	19	18	18	19	16	18	19	19	18

Day after operation.	68	75	77
Tension O. D.	18	17	18
Tension O. S.	18	19	18

Histologic examination: Scleral scar distinctly seen. Ciliary body normal in appearance and firmly attached anterior to scleral incision. There was a small anterior synechia near limbus but it did not include the root of the iris.

Rabbit No. 9.

Operated Feb. 5,

Satisfactory operation. Reaction moderate lasting five days. Rabbit became ill and was killed March 6.

Day after operation.		1	2	4	6	9	12	15	19	23	25	29	32
Tension O. D.	18	13	14	19	15	20	18	19	18	20	18	20	19
Tension O. S.	20	20	20	22	22	20	20	17	22	20	18	20	19

Histologic examination: Sclera healed. Ciliary body reattached and showed practically no evidence of operation.

Rabbit No. 10.

Operated February 24.

Operation was satisfactory with but very slight reaction. Examination two days later showed small area at limbus slightly hazy which practically disappeared before eye was enucleated April 23.

Day after operation.		1	2	4	7	9	13	16	20	23	25	29	32	35	37	40	43	49	51
Tension O. D.	20		18	14	18	16	15	17	15	18	19	19	17	19	18	19	17	20	20
Tension O. S.	20		19	18	18	18	20	18	20	19	18	19	19	19	20	21	20	20	19

Day after operation.	56	60	65	69
Tension O. D.	20	18	19	20
Tension O. S.	20	20	20	19

Histologic examination: Incision was closed by cicatricial tissue. The ciliary body was reattached and of normal appearance. There was practically no evidence of operation.

Rabbit No. 11.

Operated Feb 24, 1925.

Hemorrhage from the scleral vessels was rather marked but no blood entered the anterior chamber. The cornea showed a small area of opacity at the limbus 24 hours later which was very indistinct when Rabbit was killed. The reaction was moderate. Animal was killed March 13.

Day after operation.		1	2	4	7	9	13	16	18
Tension O. D.	19	5	6	7½	10	13	19	17	19
Tension O. S.	19	19	18	18	20	18	19	18	19

Histologic examination: Scleral scar distinctly seen. The line of separation of ciliary body and sclera was marked by small amount of pigment through the tissues. Ciliary body showed same appearance as non-Operated areas. There was a very small synechia.

Rabbit No. 12.

Operated February 24.

The operation was unsatisfactory as the incision was too far from the limbus and slightly deeper than it should have been which allowed a bead of vitreous to protrude into the wound and interfere with the introduction of the spatula. There was also a small hemorrhage into the anterior chamber. Reaction was moderate. The blood was absorbed by the 4th day, with the exception of a small clot at the limbus where the spatula entered the anterior chamber. This became organized. Animal was killed March 12th.

Day after operation.		2	4	7	9	13	16
Tension O. D.	20	13	14	15	12	18	20
Tension O. S.	18	18	19	22	20	18	20

Histologic Examination: The scleral incision was healed with some choroidal pigment in the cicatrix. The ciliary body had reattached but showed evidence of considerable trauma. There was round cell infiltration and inflammatory exudate present as well as migration of pigment cells the latter also extending into the line of separation of the ciliary body from the sclera.

Rabbit No. 13.

Operated February 27.

A slight hemorrhage occurred into the anterior chamber, otherwise the operation was satisfactory. The blood clot organized at the wound in angle of anterior chamber. The reaction was moderate.

Day after operation.		1	4	7	11	19	16	19	22	25	27	29	35	39	44	47	54	56
Tension O. D.	18	13	16	13	13	15	15	18	18	19	18	16	16	17	18	18	18	18
Tension O. S.	18	18	19	18	18	19	18	18	18	17	18	18	18	19	19	19	18	19

Histologic examination: The corneal incision had healed and the ciliary body had become firmly attached. The ciliary body and its processes were normal with the exception of a small anterior synechia which did not involve the root of the iris. The eye showed practically no evidence of operation.

Rabbit No. 14.

Operated February 27.

Operation was without incident with the exception of a small hemorrhage into the anterior chamber which was absorbed in the next 24 hours. There was very slight reaction.

Day after operation.	*	1	4	7	11	14	16	19	22	25	27	29	35	39	44	47
Tension O. D.	18	10	12½	12	19	18	17	18	18	17	17	17	14	14	13	15
Tension O. S.	18	18	15	18	17	18	17	18	18	19	18	19	18	18	20	19

Histologic examination: The line of separation of ciliary body from sclera was shown only by the migration of pigment. There was a great increase in the pigment in the region of the ciliary body especially in the ciliary processes. It was evident that there was a low grade uveitis although the general appearance of the eye was good when enucleated.

It is very probable that the uveitis caused the second drop in tension in this case.

Rabbit No. 15.

Operated February 27.

Operation satisfactory with moderate reaction. Examination on the 28th showed quite marked haze of cornea at site of puncture which gradually disappeared being almost gone at the end of the second week.

Day after operation.	*	1	4	7	11	14
Tension O. D.	25	5	16½	16½	18	16½
Tension O. S.	22	20	20	20	18	20

Histologic examination: Incision healed ciliary body adherent to sclera. Sclera and cornea show some thickening near limbus. Descemet's membrane missing over area of opacity and iris attached to cornea by three or four strans of iris tissue. Ciliary processes were hemorrhagic.

* Tension before operation

Influence of the operation upon the tension.

No 2.

Drop of but 3 m.m. for 48 hours after which tension was practically as before operation. Period of observation 32 days.

No. 3.

Drop of 8 m.m. Reaching former level on 5th day where it remained with the exception of 2 or 3 readings. Period of observation 81 days.

No. 4.

Drop of 10 m.m. until 12th day when slight increase occurred followed by 2nd drop. Period of observation 21 days.

No. 5.

Fall of 5 m.m. during first 24 hours. On the 3rd day the tension had returned to within 1 or 2 m.m. of the preoperative level remaining at this point throughout the period of observation of 78 days.

No. 6.

Drop of but 5 m.m. until 6th day after which time the tension was practically the same as before operation. Period of observation 30 days.

No. 7.

Drop of 5 m.m. in 24 hours remaining till 6th day after which tension gradually increased to within 2 to 3 m.m. of former level and remained almost constant till end of 69 day period.

No 8.

Drop of 3 to 4 m.m. for one week, then rise to preoperative level during 2nd week after which second drop of 3 to 5 m.m. occurred lasting till 29th day. From then on till end of 77 day period the tension was as before operation.

No. 9.

Fall of 5 m.m. until the 4th day at which time the tension rose to the preoperative level where it remained with but slight change till the end of 32 day period.

No. 10.

There was a drop of 4 m.m. during the first 24 hours with irregular readings varying from 2 to 6 points below the preoperative level until the 49th day when the latter level was reached and maintained till the end of the 69 day period.

No. 11.

Marked decrease from 19 m.m. to 5m.m. during first 24 hours, very gradual rise to former level by 13th day.

No. 12.

Tension not recorded during first 24 hours. Second day showed fall of 7 m.m. remaining nearly the same until the 13th day when it had returned to the preoperative level. Period of observation 16 days.

No 13.

Drop of 2 to 5 m.m. beginning the first 24 hours and remaining till 19th day after which preoperative tension was reached and maintained till end of 56 day period.

No. 14.

Tension not recorded first 24 hours. Second day showed drop of 8 m.m. By 11th day preoperative mark was reached and maintained till 22nd day. Tension again gradually dropped 3 to 4 m.m. and remained so till end of 47 day period.

No 15.

Marked drop from 25 m.m. to 5m.m. in 24 hours. On 4th day it had risen to 16.5 and remained at this point till the end of the 14 day period.

Chart showing tension before and after operation

Case No 2

ollowing ion		*	1	2	5	6	9	12	15	18	22	28	32
on	O.D.	19	16	18	18	16	18	16	17	18	18	17	18
	O. S	19	19	20	20	20	18	20	18	18	19	18	18

Case No 3

ollowing ion		*	1	2	5	7	9	12	15	18	22	28	32	35	40	43	46	51	53	59	61	65	71	79	81
on	O.D.	18	12	10	18	14	19	18	18	20	17	18	18	18	15	18	17	18	18	18	20	19	18	19	19
	O.S.	18	17	18	18	15	18	19	19	19	20	19	18	20	18	19	19	20	19	19	20	20	19	19	19

Case No 4

fter ion		*	1	2 4	4	6	8	11	14	17	21
on	O.D.	22	12	12	13	13	18	18	19	15	13
	O.S.	20	19	20	20	20	22	19	20	19	19

Case No 5

ollowing ion		*	1	3	4	6	8	11	14	17	21	25	29	35	38	40	43	46	49	51	53	50	63	71	78
on	O.D.	20	15	19	20	13	18	18	18	19	19	18	18	18	18	17	17	18	19	18	18	18	17	18	18
	O.S.	19	19	18	17	15	20	18	18	19	19	17	18	17	20	19	18	17	19	18	18	19	20	18	19

Case No 6

ollowing ion		*	2	4	6	8	11	14	17	21	24	28	30
on	O.D.	20	14	15	20	20	18	18	20	19	19	18	19
	O.S.	20	20	19	20	19	18	22	22	17	20	20	20

Case No 7

ollowing ion		*	2	4	6	9	12	16	21	24	28	31	34	37	39	42	45	50	54	59	63	69
on	O.D.	20	15	14	17	18	20	18	17	18	17	17	19	17	18	18	18	20	17	19	18	18
	O.S.	20	20	20	19	20	20	20	19	19	20	20	20	18	19	20	20	25	20	19	18	19

Case No 8

ollowing tion		*	2	4	6	9	12	15	19	23	25	29	32	35	37	40	43	49	51	56	50	58	75	77
on	O.D.	18	15	13	14	18	19	15	13	13	15	19	19	18	19	17	17	18	19	17	18	18	17	18
	O.S.	17	19	17	17	18	17	17	18	18	17	19	19	18	18	19	16	18	19	19	18	18	19	18

Case No 9

ollowing tion		*	1	2	4	5	9	12	15	19	23	25	29	32
on	O.D.	18	13	14	19	15	20	18	19	18	20	18	20	19
	O.S.	20	20	20	22	22	20	20	17	22	20	18	20	19

Case No 10

following ration		*	1	2	4	7	9	13	16	20	23	25	29	32	35	37	40	43	49	51	56	60	65	69
sion	O.D.	20	14	18	14	18	16	15	17	15	18	19	17	17	19	18	19	17	20	20	20	18	19	20
	O.S.	20	19	19	18	18	18	20	18	20	19	18	19	19	19	20	21	29	29	19	20	20	20	19

Case No 11

following ration		*	1	2	4	7	9	13	16	18
sion	O.D.	19	5	6	7½	10	13	19	17	19
	O.S.	19	19	18	18	20	18	19	18	19

Case No 12

following ration		*	2	4	7	9	13	16
sion	O.D.	20	13	14	15	12	18	20
"	O.S.	18	18	19	22	20	18	20

Case No 13

following ration		*	1	4	7	11	14	16	19	22	25	27	29	35	39	44	47	54	56
sion	O.D.	18	13	16	13	13	15	15	18	18	19	18	16	18	17	18	18	18	18
"	O.S.	18	18	19	18	18	19	18	18	18	17	18	18	18	19	19	19	18	19

Case No 14

following ration		*	1	4	7	11	14	16	19	22	25	27	29	35	39	44	47
sion	O.D.	18	10	12½	12	19	18	17	18	18	17	17	17	14	14	13	15
"	O.S.	18	18	15	18	17	18	17	18	19	18	19	18	18	20	19	

Case No 15

following ration		*	1	4	7	11	14
nsion	O.D.	25	5	16½	16½	18	16½

* Tension before operation

No	Effect on tension	Amt of decrease	Time of greatest Decrease	Period of reduced tension	Permanent effect on tension
2	Decreased	3 m.m.	1st 24hrs	2 days	Practically nil
3	"	8 m.m.	2nd 24 "	5 "	"
4	"	10 M.m.	1st 48 "	7 "	Slight
5	"	5 m.m.	1st 24 "	1 "	"
6	"	6 m.m.	1st 24 "	5 "	Nil
7	"	6 m.m.	2nd 24 "	11 "	Slight
8	"	5 m.m.	4th day	8 "	Nil
9	"	5 m.m.	1st 24hrs	3 "	"
10	"	6 m.m.	1st 24 "	21 "	"
11	Marked decrease	14 m.m.	1st 24hrs	12 "	"
12	"	7 m.m.	1st 48 "	15 "	Questionable account short period
13	"	5 m.m.	1st 24 "	16 "	Nil
14	"	8 m.m.	1st 24 "	10 " 2nd drop 3rd week	Questionable account Uveitis
15	"	20m.m.	1st 24 "	Entire period of observation	Questionable account short period

Chart showing effect of operation upon the intraocular tension.

As will be noticed from the foregoing notes and the accompanying chart he tension was reduced in every instance. The drop in tension occurring in all cases, ith the exception of two, during the first 24 hours, in one of the remaining cases uring the 2nd 24 hours and in the other between the 2nd and 5th day.

The amount of reduction varied from 2m.m. to 20 m.m. The average being 5 5/7 .m. In the majority of cases the reduction was from 6 to 8m.m.

The period of reduced tension varied from 24 hours to 16 days. With the xception of case 14 in which the uveitis may have caused the 2nd drop during the 3rd week.

It is of interest to note, at this time, the tension of the eyes in the series before operation, as well as the comparative readings in the non-operated eyes. In the former the tension renged from 18 to 22 m.m. with the exception of two eyes, one which registered 17 m.m. the other 25 m.m. Nine eyes registered 18 m.m., 5 registered 19 m.m., 10 registered 20 m.m. and 2 registered 22 m.m. The average tension being 19 11/28 m.m. as to the nonoperated eyes the readings varied within very small limits seldom more than 2 points. This differs considerably, from the twnsion of rabbits' eyes as found by Boyden (6) who gives as the normal 24 to 26 to 27 m.m.

Reviewing the histologic findings we found the scleral incisions readily healed usually with cicatricial tissue in the wound.

There was a firm reattachment between the ciliary body and the sclera with no evidence of a permanent filtration path, fistulous openings or delicate cicatricies to permit of permanent drainage.

Evidence of atrophy of the ciliary body or processes

was not noted although it is logical to expect it.

There were anterior synechiae in 5 cases. In each case small, not involving the root of the iris, and apparently not influencing the tension.

In six cases there were small corneal opacities near the limbus located in the substance of the cornea as determined by the slitlamp. With exception of No. 2 they were very faint and scarcely noticeable. The tendency was to disappearance.

The histologic examination of the eyes which were operated immediately before enucleation was as follows:

Rabbit No. 2.

The line of separation of the ciliary body and sclera was distinctly seen containing a small quantity of blood. The parts were lying in close apposition with no evidence of injury to the ciliary body or endothelium of the cornea.

Rabbit No. 6.

There was no damage sustained by the tissues other than that necessary to cause the separation of the tissues. There was no blood in the wound.

Rabbit No. 8.

Apparently there was but little damage done to the tissues however the path of separation contained blood and hemorrhage was also present in some of the ciliary processes. Descemet's membrane had been detached from the corneal stroma instead of having been penetrated by the spatula.

Rabbit No. 10.

In this specimen there was no evidence of damage to the tissues with the exception of damage to Descemet's membrane which had been detached for a short distance before it was penetrated.

Rabbit No 11.

Separation had been accomplished with but little trauma. There was no evidence of hemorrhage. Descemet's membrane was not injured.

Reviewing the literature concerning experimental works in cyclodialysis done upon animals and microscopical examination of human eyes in which the operation was not successful we find:

"Wichodzeff (7) operated 14 times upon dogs and 8 times upon rabbits and found pupil changes immediately after operation only when the aqueous escaped. After a few hours the normal tension and normal width of the pupil were restored. Microscopical examinations were made of theeyes enucleated at varying times after operation. In order to determine whether cyclodialysis produced a communication between the anterior chamber and the supra-choroidal space, he made an injection of soluble Berlin blue into the anterior chamber several hours before the enucleation. Under the microscope he found ordinary tears in the processes of the space of Fontana, detachment of Descemet's membrane and in several cases broad attachment of the iris periphery and the denuded corneal stroma.

Detachment of the ciliary body and choroid from the scler was never observed, nor was there ever any Berlin blue in the supra-choroidal space. He therefore concluded that by cyclodialysis no

new paths were opened for draining the aqueous, but on the contrary the usual paths were partly occluded by deformation of the chamber angle. He could not therefore recommend the operation although he recognized the fact that the results of his experiments could be applied only withsome reservations to the glaucomatous eye."

"Judin(8) reported his results of 26 experimental operations on dogs eyes. The intraocular pressure was measured by Maklakloff's tonometer and showed a decrease of an average of 9.3 m.m. Hg. after a lapse of 9 to 10 days. In the course of 4 weeks tension returned to normal (30 to 32 m.m. Hg.) Fifteen eyes were examined anatomically at varying intervals after operation. At the end of the 3rd week the scleral wound was healed with the formation of a firm connective tissue scar. There was no instance of detachment of the ciliary body from the sclera, but on the contrary the former was drawn into the wound soon after the operation; both were firmly adherent. In the region of the operation the trabeculae of the ligamentum pectinatum were united by firm connective tissue adhesions and in almost all the cases there was detachment of Descemet's membrane. Judin therefore does not believe that the operation will replace the earlier methods of treatment."

"Krauss(2) operated upon 20 eyes of rabbits and 12 eyes of cats. The resultswere the same in all.

1. In all cases a solid cicatrix had formed at the sight of operation.
2. The vitreous occasionally showed here, and between it and the ciliary body slight fibrous bands.
3. The choroid was always tightly adherent to the sclera.
4. The ciliary body was fixed to the sclera by scar tissue and

the ciliary processes were thickened by cicatrices or atrophic.

5. The iris occasionally appeared atrophic in the region of the detachment and always was adherent to the cornea.

6. The sinus of the anterior chamber was in all cases obliterated. The base of the iris was always adherent to the cornea by cicatricial tissue extending far forward.

7. The anterior chamber at the side of the cyclodialysis was more shallow and in the sinus fibres and leucocytes were found.

8. The cornea showed detachment of the endothelium and Descemet's membrane, which not infrequently had happened at the operation. A lasting opacity followed these in some eyes."

"Wernecke (4) did experimental investigation on rabbits and dogs. He states the effects were not comparable to that in humans. No dense scars could be found however opposite the wounds, and while no open communications could be found between the anterior chamber and the suprachoroidal space, this may be due to fault in preparation, the result of shrinking. In human eyes examined pathologically there was no more atrophy of the iris and ciliary body on the side where the operation had been made than at the site of an iridectomy."

In one case of hemorrhagic glaucoma operated by Axenfeld in which the eye was later secured for microscopical examination there was no sign of a communication between the anterior chamber and suprachoroidal space, and at the place of operation the anterior chamber was shallower than elsewhere and the adhesion between the iris and cornea more extensive, the ciliary body was atrophied and

adherent to the sclera so that the space made by the stylet at the

time of the operation was obliterated.(9)

Meller (9) has shown Microscopic sections of eyes in which the operation was not successful. They showed freeing of the angle, detachment of Descemet's membrane and injury to the vitreous. The scar appeared as a narrow line of scar tissue which apparently was not capable of filtration.

CONCLUSIONS.

From the foregoing studies we arrive at the following conclusions:

(1) Cyclodialysis is an operation which will reduce intraocular tension.

(2) The reduction in tension is but moderate and only temporary.

(3) There is no evidence of a filtration path or other means of drainage in the suprachoroidal spaces after the first few weeks.

(4) There is apparently no atrophy of the ciliary body.

(5) The reduction in tension other than that caused by the evacuation of the anterior chamber, is due to the formation of a temporary drainage canal, between the ciliary body and the sclera, connecting the anterior chamber and the suprachoroidal spaces.

(6) The tissues reunite in close apposition soon after the operation thus closing the temporary path of filtration and preventing further drainage after which time the tension rises and tends to approach the preoperative level.

(7) The principal immediate complications, other than hemorrhage or that due to improper technique, is detachment of Descemet's membrane with difficulty in or failure in entering the anterior chamber. Injury to Descemet's membrane is followed by corneal opacities which may or may not tend to disappear and by anterior synechiae which are permanent. While these anterior synechiae may be of no consequence in an eye with normal tension they may have a great influenceupon the tension of a glaucomatic eye.

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(8) It would seem that the facts obtained in the experimental studies are n accord with the general clinical experience, that is, that the effects of the oper-ion are moderate and only temporary: that it is not free from danger or complications. hat it is not founded on sound surgical principles and that it is not only not the peration of choice for reduction of tension in glaucomatous eyes but is of practically o value, even in the very type of cases in which it is ordinarily done.

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